CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER No. 88-103

SITE CLEANUP ORDER AND RESCISSION OF ORDER NO. 87-108 FOR:

LAWRENCE LIVERMORE NATIONAL LABORATORY
and,
U. S. DEPARTMENT OF ENERGY
ALAMEDA COUNTY

1. Lawrence Livermore National Laboratory (LLNL) operates a research facility under contractual aggreement with the U. S. Department of Energy (DOE) on 811 acres of land owned by DOE in the Livermore Valley, Alameda County. Lawrence Livermore National Laboratory and the U. S. Department of Energy are hereinafter both dischargers. For the purposes of this Order, DOE will be responsible for compliance in the event that LLNL fails to comply with the requirements of this Order.

2. On July 17, 1987, Lawrence Livermore National Laboratory was placed on the National Priority List (NPL) and became subject to the Federal Superfund regulations under the authority of the U. S. Environmental Protection Agency (EPA). In April, 1987, the EPA began negotiations with DOE, LLNL, and interested State and local agencies to enter into an Interagency Agreement for site investigation and remediation in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, and the Superfund Amendments and Reauthorization Act (SARA) of 1986.

3. The LLNL site is located in the eastern part of the Livermore-Amador Valley. The site was first used by the U. S. Navy beginning in the 1940's as a Naval Air Station. Subsequently the site has been used as a research facility by the U. S. Atomic Energy Commission, and now by its successor agency the U. S. Department of Energy. Hazardous materials have been used, stored, and disposed of on the site since its first use by the U. S. Navy. Chemical handling and storage facilities are currently regulated by Resource, Conservation and Recovery Act (RCRA) regulations administered by State and Federal agencies.

4. Hydrogeologic investigations conducted since 1983 show that soil and ground water beneath the site, and in offsite areas, are polluted with constituents that have either current or historical useage onsite. These pollutants include trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), tetrachloroethylene (PCE), 1,1-dichloroethylene

(1,1-DCE), 1,1-dichloroethane (1,1-DCA), carbon tetrachloride, and petroleum hydrocarbons locally. Also, some heavy metals such as chromium have been detected at elevated levels, although these levels may be background.

5. In April, 1983, the dischargers drilled monitor wells onsite and found some to be polluted with halogenated hydrocarbons, such as TCE and PCE. Similar pollutants were found in downgradient private wells in December 1983. The California Department of Health Services (DOHS) issued an Order of Compliance on September 11, 1984 requiring the dischargers to notify owners of the polluted drinking water wells and to provide the owners with a clean water supply.

6. Site investigative work was conducted during 1984 and 1985 to determine sources and extent of soil and ground water pollution. Various locations of soil pollution were identified, and the lateral and vertical extent of offsite ground water pollution (extending from the southwest corner of the site), as well as local hydrogeologic conditions, were defined.

7. On August 19, 1987 the Regional Board adopted Order No. 87-108 as a site cleanup order to revise the work schedule and to accommodate additional and more complete subsurface investigations that are needed based on LLNL's previous work. The Order rescinded the previous Orders 85-134 and 86-95.

8. Site investigative work completed to date has shown that the hydrogeology of the site area, in the eastern Livermore-Amador Valley, is complex and heterogeneous. Borehole and monitor well data indicate that alluvial beds comprising the subsurface stratigraphy dip generally to the northwest, and horizontal hydraulic conductivities may have a preferred northwest orientation. Ground water gradients in the site area indicate ground water flow generally to the west and northwest. In the southeast quarter of the site the ground water gradient indicates a local southerly flow.

9. More than 200 monitoring wells have been installed onsite and offsite by the dischargers. Ground water monitoring data indicate that ground water is polluted locally beneath the site, and that plumes of polluted ground water extend offsite from the southwest and south central boundaries of the site. A localized area of ground water pollution is also located offsite to the northwest.

10. For portions of the site proper, the extent of soil and ground water pollution has not been fully determined. In offsite areas, the southwest plume is best defined as about

4000 feet long, about 2000 feet wide and 50 to 120 feet thick. Additional studies are being conducted to fully define the extent and migration characteristics of the offsite plumes as well as onsite soil and ground water pollution.

11. The portion of the Livermore-Amador ground water basin which LLNL occupies, part of the Mocho I and Spring subbasins, is a ground water recharge area recognized in the San Francisco Bay Basin Plan and in technical reports submitted by the dischargers. Existing private wells in the Mocho I subbasin are used for irrigation and domestic water supply. The California Water Service operates several municipal wells in the Mocho II subbasin, which begins approximately one and one-half miles west of the site.

12. The dischargers have surveyed all water supply wells within a one mile radius of the site, and submitted a report "Evaluation of Wells West of LLNL for Inter-Aquifer Cross-Connection", dated August 20, 1986. Of the wells identified, some are designated for closure due to pollution of the well and others due to potential to serve as vertical conduits for pollution migration. A workplan for well closure will be submitted by LLNL to the Regional Board for review according to Provision C.4 of this Order.

13. The dischargers plan to conduct pilot extraction test studies in the southwest offsite plume and Building 403 gasoline spill areas. The purpose of these studies is to develop design criteria for evaluation and preparation of remedial alternatives for site cleanup. Clean up alternatives will be submitted as specified in Provision C.4. Selection and implementation of cleanup alternatives will be accomplished in cooperation between the Regional Board and the EPA pursuant to CERCLA/SARA regulations.

14. The dischargers plan to conduct ground water recharge studies as part of the proposed pilot study for the southwest offsite plume area. The recharge studies would determine the rate or magnitude of recharge which will occur in areas designated for discharge along Arroyo Seco and Arroyo Las Positas, and within adjacent DOE property designated for discharge to land.

15. LLNL has submitted site investigative reports in compliance with the requirements of Order 87-108. Release Reports for the entire site document possible sources for release of pollutants to soil and ground water. Extent Reports for the Building 403 gasoline spill, southwest and southwest offsite areas provide information about extent of soil and ground water pollution and general site hydrogelogic conditions. A draft Remedial Alternative Report for the southwest offsite

area has been submitted and will be submitted in final form and to conform with EPA requirements as specified in provision C.4(g)(h).

16. In a letter dated January 22, 1988 LLNL requested that Site Cleanup Order 87-108 be revised to incorporate requirements of the CERCLA/SARA regulations. Revisions to Order 87-108 consist primarily of modifications in the task list and time schedule. These revisions retain the basic requirements for site investigation and cleanup as specified in Order 87-108 while incorporating the format and time frame of CERCLA/SARA requirements. Elements of the task schedule of this Order, outstanding upon final negotiation, are anticipated to be included in an Interagency Agreement for the LLNL site. Some of these deadlines may be affected by agency response times.

17. On April 20, 1988 the Regional Board adopted NPDES Permit No. CA0029289 that regulates the discharge of treated waste ground water by LLNL into waters of the State. The waste ground water is generated from routine monitor well development, testing and sampling, a proposed pilot study for the southwest offsite plume area, and site cleanup when a remedial alternative is approved by the EPA.

18. A portion of the treated waste ground water generated from the proposed pilot study in the southwest offsite area is regulated under separate Waste Discharge Requirements. Discharge is to land on adjacent DOE property.

19. The Regional Board adopted a revised Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan) on December 17, 1986. The Basin Plan contains water quality objectives for non-tidal waters including Arroyo Mocho, Arroyo Seco, Arroyo Las Positas, Arroyo de la Laguna, and their tributaries, and for Livermore-Amador Valley ground waters.

20. The existing and potential beneficial uses of the ground waters underlying the Livermore-Amador Valley ground water basin and its subbasins include:

    a. Municipal and domestic supply
    b. Industrial supply
    c. Industrial service supply
    d. Agricultural supply

21. The existing and potential beneficial uses of the surface waters in the Livermore-Amador Valley ground water basin including Arroyo Mocho, Arroyo Seco, Arroyo Las Positas, Arroyo de la Laguna and their tributaries include:

    a. Contact and non-contact water recreation

b. Wildlife habitat
c. Ground water recharge
d. Fish migration and spawning

22. The dischargers have caused or permitted and threaten to cause or permit, waste to be discharged or deposited where it is or probably will be discharged to waters of the State and creates or threatens to create a condition of pollution or nuisance.

23. This action is an order to enforce the laws and regulations administered by the Board. This action is categorically exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to Section 15321 of the Resources Agency Guidelines.

24. The Board has notified all interested agencies and persons of its intent under Section 13304 of the California Water Code to prescribe Site Cleanup Requirements for the discharge and has provided them with the opportunity for a public hearing and an opportunity to submit their written views and recommendations.

25. The Board, at a public meeting, heard and considered all comments pertaining to this discharge.

IT IS HEREBY ORDERED, pursuant to Section 13304 of the California Water Code, that Lawrence Livermore National Laboratory and the U. S. Department of Energy shall cleanup and abate the effects described in the above findings as follows:

A. PROHIBITIONS

1. The discharge or disposal of wastes or hazardous materials in a manner which will degrade the water quality or adversely affect the beneficial uses of the ground waters of the State is prohibited.

2. The discharge of wastes or hazardous materials through direct surface discharge or runoff or subsurface transport which will degrade the water quality and adversely affect the beneficial uses of the surface waters of the State is prohibited.

3. Activities associated with onsite and offsite investigation and site cleanup which will cause significant adverse migration of the pollution are prohibited.

4. The cleanup and containment of any polluted soil or ground water by the dischargers which will cause

significant adverse spreading or migration of any pollution originating from other sites is prohibited.

B. SPECIFICATIONS

1. The horizontal and vertial extent of onsite and offsite soil and ground water pollution shall be assessed and defined.

2. Local and regional hydrogeologic conditions shall be defined in the areas of and contiguous to identified pollution.

3. Private wells in the area of the pollution which have been identified as actual or potential conduits for the spread of ground water pollution shall be properly sealed or abandoned, to the extent legally possible.

4. The storage, handling, treatment or disposal of polluted ground water shall not create a nuisance as defined in Section 13050(m) of the California Water Code.

5. NPDES Permit No. CA0029289 and Waste Discharge Requirements shall regulate the discharge of waste ground water which may contain volatile organic, petroleum hydrocarbon, or other pollutants, generated as described in Finding 17. Such effluent shall be treated before discharge to waters of the State or to land. Sampling and analysis of treated effluent, and conditions of compliance shall be in accordance with the self-monitoring plan contained in the NPDES permit and Waste Discharge Requirements.

C. PROVISIONS

1. Lawrence Livermore National Laboratory shall perform all investigation and remedial work in accordance with the requirements of this Order. For the purposes of enforcing this Order, the U. S. Department of Energy shall be responsible for achieving full compliance in the event that Lawrence Livermore National Laboratory fails to comply with the requirements of this Order.

2. LLNL shall submit to the Board technical reports on any work performed according to a program approved by the Board's Executive Officer. All reports shall be satisfactory to the Executive Officer, and, if necessary, the dischargers may be required to submit additional information.

3. Investigative or other technical studies shall consider the LLNL site as one contiguous site.

4. To comply with all Prohibitions and Specifications of this Order, LLNL shall meet the following compliance task and time schedule. This schedule includes modifications described in Finding 16.

COMPLIANCE TASK SCHEDULE

Compliance Documents and Tasks	Compliance Date
a. PRIVATE WELL CLOSURE PLAN Workplan and time schedule for closure of all private wells identified as actual or potential pollution conduits.	7/1/88
b. PILOT EXTRACTION TEST STUDY FINAL PROPOSAL Workplan and time schedule to conduct pilot study in the southwest offsite plume area.	8/1/88
c. BUILDING 403 PILOT EXTRACTION TEST STUDY PROPOSAL Workplan and time schedule to conduct pilot study in the Building 403 gasoline spill area.	8/1/88
d. PRIVATE WELL CLOSURE SUMMARY Technical report documenting work done for closure of all pollution conduit private wells submitted as separate chapter in monthly progress report.	9/1/88
e. UNDERGROUND TANK MITIGATION SUMMARY Technical report documenting work done for correction of all leaking underground tanks to include gasoline, diesel and rinse tanks actions, and a plan for an annual leak test program. Report may consist of compendium of county reports and the leak test program.	10/1/88
f. DRAFT HYDROGEOLOGIC TECHNICAL REPORT Summary of hydrogeologic conditions for site/vicinity and extent of soil/ground water pollution. Shall conform to EPA RI/FS guidelines.	10/1/89
g. DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY Technical report on hydrogeologic conditions, extent of soil/ground water	5/1/90

pollution, and site remediation alternatives. Shall conform to EPA RI/FS guidelines.

h. FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY — 60 days
Final report to incorporate State/Federal agency and public comments on draft RI/FS report. Final report due from dischargers within 60 days of transmittal of Executive Officer's comments on Task 4.g.

i. DRAFT REMEDIAL ACTION PLAN — 5/1/91
Workplan and time schedule for selected site remedy implementation. Shall conform to EPA Remedial Action Plan guidelines.

j. FINAL REMEDIAL ACTION PLAN — 60 days
Final plan to incorporate State/Federal agency and public comments on draft Remedial Action Plan. Final plan due from dischargers within 60 days of transmittal of Executive Officer's comments on Task 4.i.

5. The Remedial Investigation/Feasibility Study Reports shall contain, as a minimum:

a. An assessment of the overall hydrogeology and migration of pollution for the site and offsite areas that are, or may be, affected. This assessment shall address:

1) geology of site area and physical parameters for all subsurface stratigraphic units,
2) hydraulic characteristics of water bearing zones including direction and velocity of ground water flow,
3) hydraulic communication and potential for migration of pollution between any and all water bearing zones,
4) migration of pollution with respect to recharge and discharge areas, time, and any other impacting factors, and
5) influence on pollution migration of pumping of private wells.

b. A characterization of the nature and extent of pollution to address:

1) types and concentrations of pollutants present in soil and ground water,
2) vertical and horizontal extent of soil and ground water pollution, and

3) identification of potential pollution migration mechanisms and transport pathways.

c. Detailed evaluation of potential remedial alternatives for site cleanup. Each alternative shall be evaluated with respect to:

1) effectiveness of the cleanup alternative based upon sufficient hydrogeologic site information,
2) details of the alternative such as treatment methodology, and, if ground water extraction is proposed, flow capture zone, areas of influence per extraction well, chemical monitoring data, and other pertinent information,
3) manner and location of discharge, if an element of the cleanup alternative,
4) details of soil removal/disposal, if an element of the cleanup alternative,
5) cost,
6) benefits, and
7) impacts on public health, welfare and the environment.

6. The Remedial Investigation/Feasibility Study Report shall consider the guidance provided by Subpart F of the National Oil and Hazardous Substances Pollution Contingency Plan (40 CFR Part 300), Section 25356.1(c) of the California Health and Safety Code, and applicable EPA CERCLA/SARA guidance documents.

7. Documentation of compliance with the Specifications and Provisions of this Order shall include ground water contour maps, pollutant concentration contour maps, geologic cross sections, borehole logs (ie., lithologic and geophysical), and laboratory analyses. The documentation shall be updated as appropriate and submitted with each technical report required under this Order.

8. If the dischargers are delayed, interrupted or prevented from meeting one or more of the compliance dates specified in this Order, LLNL shall notify the Executive Officer by telephone prior to the compliance deadline date. Such notification in no way relieves the dischargers of their obligation of meeting these dates.

9. LLNL shall submit monthly summaries of its progress towards compliance with the Specifications and Provisions of this Order. The reports shall be

received by the Regional Board 30 days after the end of the report period. The reports shall include:

a. a summary of work completed since the previous report, and of work anticipated to be completed but was in fact not completed,
b. work anticipated to be completed over the coming two report periods,
c. identification of potential problems which will cause or threaten to cause noncompliance with this Order, and
d. documentation of events of noncompliance and the reasons therefore, and a plan for achieving compliance.

10. LLNL shall report to the Board annually commencing by January 31, 1989 for the 1988 calendar year, on the effectiveness of the investigation and remedial design program. The report shall summarize all work accomplished, and provide updated maps and illustrations, and an updated schedule of sampling and analysis for each monitoring well. The annual report shall be submitted with the December monthly progress report due by January 31st of the following year.

11. LLNL shall submit a schedule of sampling with the monthly progress report due by July 31, 1988, that shall include the frequency of sampling and types of analyses to be conducted for each monitor well. This schedule shall appear in each Annual Report as stated in Provision 10 above.

12. Raw data from the quarterly sampling of monitoring wells and private wells shall be submitted no later than the last day of the following months: February, May, August, and November.

13. All samples shall be analyzed by State certified laboratories using approved EPA methods for the type of analysis performed. All laboratories shall maintain quality assurance/quality control records for Board review.

14. All hydrogeologic plans, specifications, reports, and documents shall be signed by or stamped with the seal of a registered geologist, engineering geologist, or professional engineer.

15. LLNL shall maintain in good working order, and operate as efficiently as possible, any facility or control system installed to achieve compliance with the requirements of this Order.

16. Copies of all correspondence, reports, and documents pertaining to compliance with the Prohibitions, Specifications, and Provisions of this Order shall be provided to the following agencies:

    a. California Department of Health Services/TSCD
    b. State Water Resources Control Board
    c. U. S. Environmental Protection Agency/Region IX
    d. Zone 7 of the Alameda County Flood Control District

17. Order No. 87-108 is hereby rescinded.

18. The dischargers shall permit the Board or its authorized representative, in accordance with Section 13267(c) of the California Water Code:

    a. entry upon premises in which any pollution sources exist, or may potentially exist, or in which any required records are kept,
    b. access to copy any records required to be kept under the terms and conditions of this Order,
    c. inspection of any monitoring equipment or methods required by this Order,
    d. sampling of any ground water or soil which is accessible, or may become accessible as part of any investigation or remedial action program, to the discharger.

19. The dischargers shall file a report on any changes in site occupancy and ownership associated with the facility described in this Order.

20. LLNL shall report any newly discovered spill of oil or other hazardous material. Spills shall be reported to this Regional Board at (415)464-1255 on weekdays during office hours from 8 a.m. to 5 p.m., and to the Office of Emergency Services at (800)852-7550 during non-office hours, by telephone immediately after discovery of occurrence. A written report shall be filed with the Regional Board within five (5) working days and shall contain information relative to the nature of waste or pollutant, quantity involved, duration of incident, cause of spill, estimated size of affected area, nature of effects, corrective measures that have been taken or planned, and a schedule of these activities, and persons notified.

21. This Order is issued to the dischargers to require investigation and cleanup of site soil and ground water pollution, and is in support of requirements of

CERCLA. Pursuant to CERCLA Section 120, all response actions taken by the dischargers must be consistent with all guidelines, rules, regulations, and criteria developed by the EPA pursuant to CERCLA. Issuance of this Order does not constitute approval by the State of California or EPA for any response or remedial activities.

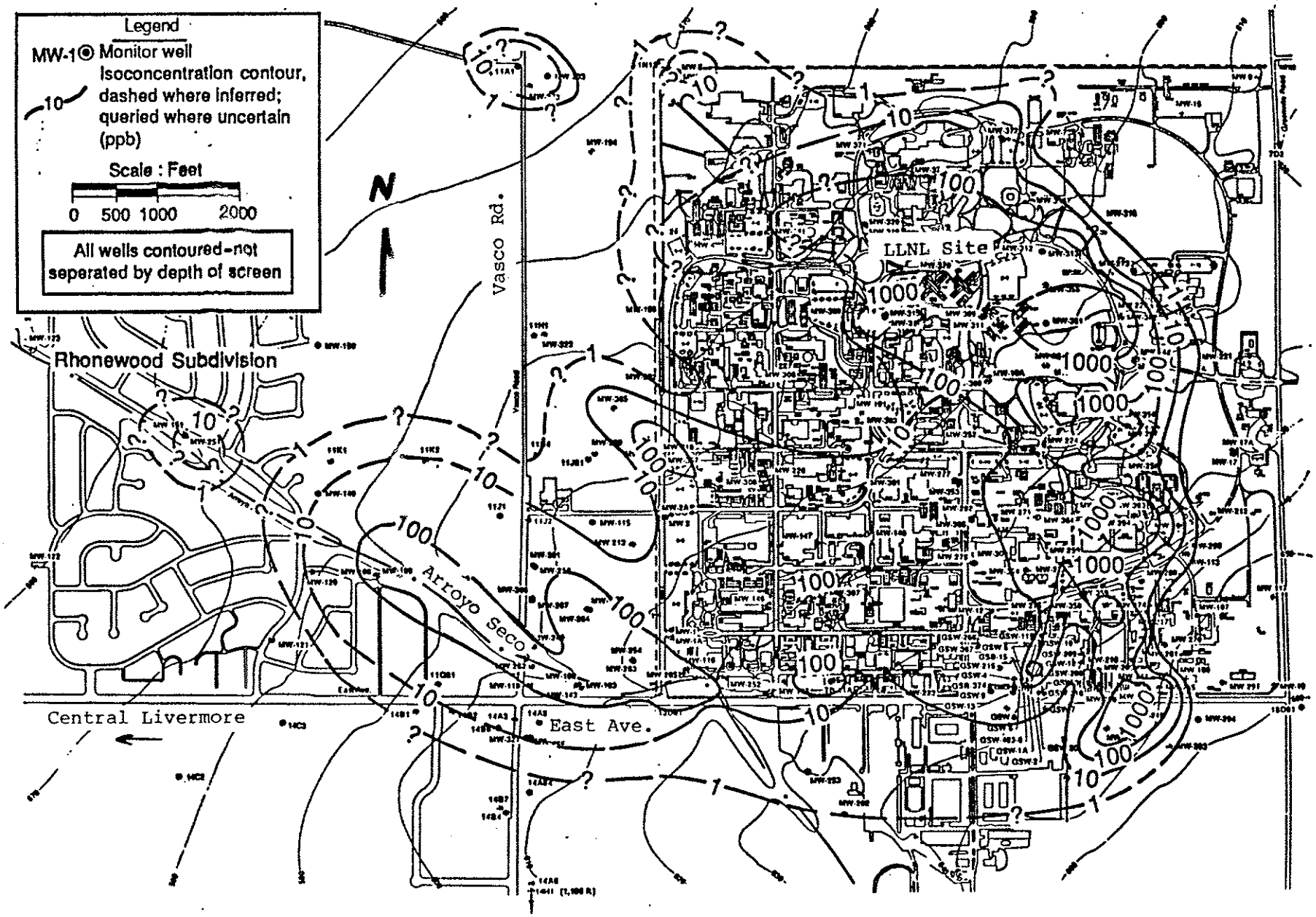
22. Within sixty (60) days of the Executive Officer's determination and actual written notice to DOE (owner) that the Lawrence Livermore National Laboratory (operator) has failed to comply with the Provisions of this Order, the DOE, as landowner shall comply with these Provisions.

23. The Board will review this Order periodically and may revise the requirements or compliance schedules when necessary.

I, Roger B. James, Executive Officer, do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on June 15, 1988.

for ROGER B. JAMES
Executive Officer

ATTACHMENTS: 1. Site Map



Lawrence Livermore National Laboratory Site

Well location map showing preliminary isoconcentration contours of total VOCs in ground water site-wide (May-July, 1987 data).